VOLUME 3 - RESOURCE MANAGEMENT STRATEGIES

CHAPTER 18

Pollution Prevention

Carmichael, CA. Two young volunteers collect debris in Arcade Creek during Creek Week, an annual program sponsored and coordinated by the Sacramento Area Creeks Council, in which volunteers improve and enhance the area's urban waterways and enjoy a week of educational activities and fun.

Contents

Boxes

Chapter 18. Pollution Prevention

Pollution prevention can be defined as the reducing or eliminating of waste at the source by modifying production processes, promoting the use of non-toxic or less toxic substances, the implementation of practices or conservation techniques including activities that reduce the generation and/or discharge of the pollutants, and the application of innovative and alternative technologies which prevent pollutants from entering the environment prior to treatment. These preventive activities can also include new equipment designs or technology, reformulation or redesign of products, substitution of raw materials, updating or improvements of existing management practices, continued maintenance of previously implemented management practices, training and education/outreach, and improved collaboration.

Pollution prevention begins at the source. Sources of water quality pollution can be categorized into two types: point-source and non-point-source. In California, point-source pollution prevention is addressed through the Clean Water Enforcement and Pollution Prevention Act of 1999, Water Code Section 13263.3(d)(1), which authorizes the State Water Resources Control Board (SWRCB), a regional water quality control board (RWQCB), or a publicly owned treatment works (POTW) to require a discharger to prepare and implement a pollution prevention plan. A point-source discharger is defined per Water Code Section 13263.3(c) as any entity required to obtain National Pollutant Discharge Elimination System (NPDES) permit or any entity subject to the federal pretreatment program. A non-point discharger is any discharger not covered by a NPDES permit.

Pollution prevention can contribute to the protection of water quality for beneficial uses by protecting water at its source and therefore may reduce the need and cost for other water management and treatment options. By preventing pollution, restoring, and then protecting improved water quality throughout a watershed, water supplies can be used and reused by a greater number and types of downstream water uses. Protecting water quality through appropriate pollution prevention is consistent with a watershed management approach to water resources problems.

As increasing emphasis is placed on protecting instream uses for fish, wildlife, recreation, and scenic enjoyment, surface water allocations administered under ever-tightening restrictions are posing new challenges and giving new direction to the SWRCB's water rights activities. In a landmark case, *National Audubon Society v. Superior Court*, the California Supreme Court held that California water law is an integration of both public trust and appropriative right systems, and that all appropriations may be subject to review if "changing circumstances" warrant their reconsideration and reallocation. At the same time, it held that like other uses, public trust values are subject to the reasonable and beneficial use provisions of the California Constitution. Together with the SWRCB, the courts have concurrent jurisdiction in this area.

The difficulty comes in balancing the potential value of a proposed or existing water diversion with the impact it may have on the public trust. After carefully weighing the issues and arriving at a determination, the SWRCB is charged with implementing the action, which would protect the latter. The courts also have concurrent jurisdiction in this area.

As with all of the other pieces of the California water puzzle, protecting through pollution prevention, restoring/improving impaired water quality, and allocating the limited resource fairly and impartially among many competing users (while not creating or increasing water quality pollution issues with these allocations), are among some of the SWRCB's greatest challenges.

Pollution Prevention in California

In the past, the main water pollution prevention focus was primarily on those from point-source discharges. Pollution can enter a water body from point-sources like municipal wastewater treatment facilities, industrial wastewater treatment facilities, or municipal discharges from stormwater runoff. In recent years, however, as point-sources have been more effectively regulated and controlled, the remaining so-called "non-point-sources" of pollution have become one of the main concerns of the SWQCB and RWQCBs. These non-point source pollutants are generated from a variety of sources, including land use activities associated with agricultural operations and livestock grazing, forestry (silviculture) practices, uncontrolled urban runoff not covered by permits, deposition of airborne pollutants, hydromodification, and discharges from marinas and recreational boating activities. There are many approaches such as regulations (e.g., dischargers under the Water Code), voluntary/self-determined (e.g., locally led entities that desire a cleaner environment and that conduct riparian and ecosystem restoration activities), or incentive-based (e.g., U.S. Department of Agriculture Natural Resource Conservation Service Environmental Quality Incentives Program (EQIP) — National Water Quality Initiatives funding for implementing Agriculturally-based Management Practices) that are available for preventing non-point source water pollution. Understanding, planning for, assessing, documenting, managing, tracking, and controlling non-point source pollution through better land use management has been and will continue to be developed. Additional information on land use is available in the "Land Use Categories and Pollution Prevention" section in this chapter or in Chapter 24, "Land Use Planning and Management," in this volume.

Coordinating the prevention of both point- and non-point sources of pollution in concert with one another has been shown to help identify priority areas of focus. As resources continue to become increasingly limited, the ability to identify and focus funding resources through coordinated efforts will be of great importance.

The U.S. Environmental Protection Agency (EPA), SWRCB, California Coastal Commission (CCC), and RWQCBs coordinate closely on non-point source pollution issues. These agencies implement permitting, enforcement, remediation, monitoring, and watershed-based programs to prevent pollution. In addition, as part of California's non-point source Program Fifteen-Year Strategy (non-point source Program Strategy) that started in 1998, the SWRCB established an Interagency Coordinating Committee (IACC) to assist other state agencies with non-point source regulatory authorities and/or land use responsibilities to familiarize themselves with each others' non-point source activities, and to better leverage their resources. The Irrigated Lands Regulatory Program Roundtables and the Marina's IACC meetings continue to be two of the most effective of these originally formed groups.

Non-point source dischargers are responsible for ensuring that their discharges do not adversely impact water quality in the state. In an effort to prevent pollution, restore impaired water quality, and protect improved water quality, a number of government agencies provide funding for water quality projects using state bond funded grants and loans, and federal Clean Water Act section 319 (CWA 319) implementation grants. Some of the government agencies that administer and provide this funding include the SWRCB, Department of Water Resources, Department of Pesticide Regulations, Department of Conservation, and EPA. Unless new state water bond funding is approved by voters in the coming years, these bond funds will eventually be depleted with only the CWA 319 implementation grants continuing through the SWRCB. The amount of federal funding made available to the SWRCB for CWA 319 implementation grants has declined by 13 percent in 2010 and 10 percent in 2011. This funding is expected to continue to decline in the future. The need for increased CWA 319 federal funding and improved collaboration, cooperation, and leveraging of all funding sources will be extremely important in order to sustain a high level of water quality improvements, pollution prevention, and restoration efforts. The SWRCB non-point source program has identified watershed-based plan development and funding coordination for implementation as a high priority.

Pollution prevention can require a cultural change, one that encourages more anticipation and internalizing of real environmental costs by those who may generate pollution, and which also requires building a new relationship with all stakeholders to find the most cost-effective means to achieve those goals.

Antidegradation Policies

Pollution prevention can be provided through the adoption and implementation of policies to protect and/or maintain high water quality. The federal Clean Water Act requires each state to adopt a statewide antidegradation policy and establish procedures for its implementation. The California and federal antidegradation policies require, in part, that where surface waters have a higher quality than necessary to protect beneficial uses (e.g., designated uses of the water which can include, but are not limited to, domestic, municipal, agricultural and industrial supply, power generation, recreation, aesthetic enjoyment, navigation, and preservation and enhancement of fish, wildlife, and other aquatic resources or preserves), the high quality of those waters must be maintained unless otherwise provided for by the policies. The federal antidegradation policy prohibits any activity or discharge that would lower the quality of surface water that does not have assimilative capacity with limited exceptions. The California Antidegradation Policy, which predates the federal Clean Water Act, was adopted by the SWRCB in 1968 as SWRCB Resolution No. 68-16. SWRCB Resolution 68-16 establishes the requirement that state water discharges be regulated to achieve the “highest water quality consistent with maximum benefit to the people of the state.” The state’s Antidegradation Policy applies more comprehensively to water quality changes than the federal policy because it also applies to groundwater and not just surface water.

The Antidegradation Policy has been incorporated into all RWQCBs’ water quality control plans (basin plans). A basin plan establishes a comprehensive program of actions designed to preserve, enhance, and restore water quality in all water bodies within the state. The basin plan is each RWQCB’s master water quality control planning document and includes the beneficial uses of water within the RWQCB’s jurisdiction, water quality objectives to protect the beneficial uses, and a program of implementation to achieve the water quality objectives. Federal laws require states to adopt water quality standards. In California, the beneficial uses and water quality objectives are the state’s water quality standards.

Water Quality Monitoring

California Water Quality Monitoring Council

Senate Bill 1070 was enacted to orchestrate more effectively the many water quality monitoring efforts already in progress within the state, and to make that process more visible to users and to entities committed to the protection, monitoring, and supply of water to all its users. It provides for the creation of a structure to allow the public to access any available water quality data, current methods and research, as well as current regulations and enforcement actions. The bill also created the California Water Quality Monitoring Council to connect the myriad activities throughout the state in a more cohesive and sensible manner with the ability to provide direction to reduce redundancies, prioritize actions, and recommend funding necessary to provide the critical information necessary to protect California's water.

The California Water Quality Monitoring Council provides multiple perspectives on water quality information and highlights existing data gaps and inconsistencies in data collection and interpretation, thereby identifying areas for needed improvement in order to address the public's questions. The Monitoring Council has developed a set of "My Water Quality" Internet portals supported by expert stakeholder work groups, which include members from local, state, federal, and non-governmental organizations. The initial Internet portals were developed around water quality themes in an easy to understand manner and to answer the following water quality questions:

- Is It Safe To Swim In Our Waters?
- Is It Safe To Eat Fish and Shellfish From Our Waters?
- Are Our Ecosystems Healthy?

Additional "My Water Quality" Internet portals are planned and will address the following water quality questions:

- Is Our Water Safe to Drink?
- Are Our Stream and River Ecosystems Healthy?
- Are Our Tidepool Ecosystems Healthy?
- Are Our Estuary Ecosystems Healthy?
- Are Our Ocean Ecosystems Healthy?

Surface Water Ambient Monitoring Program

The Surface Water Ambient Monitoring Program (SWAMP) is a statewide monitoring effort that provides the scientifically sound data necessary to manage California's water resources effectively. Ambient monitoring refers to the collection of information about the status of the physical, chemical, and biological characteristics of the environment. The SWRCB and the RWQCBs introduced SWAMP in 2001. The program's purpose is to monitor and assess water quality to determine whether California is meeting its water quality standards and protecting its beneficial uses. Data from SWAMP are used to improve the state's water quality assessment and impaired water bodies list, required under CWA Sections 305(b) and 303(d), respectively. In addition, regional efforts underway by the Central Coast Ambient Monitoring Program are briefly described in Box 18-1.

Box 18-1 Central Coast Ambient Monitoring Program

The Central Coast Ambient Monitoring Program (CCAMP) is the Central Coast's regional component of SWAMP. CCAMP plays a key role in assessing Central Coast regional goals and has a number of program objectives: (1) assess watershed condition on a five-year rotational basis using multiple indicators of health, (2) assess long-term water quality trends at the lower ends of coastal creeks, (3) conduct periodic assessments of harbors, estuaries, lakes, and near-shore waters using multiple indicators of health, and (4) support investigations of other water quality problems including emerging contaminants, sea otter health, pathogenic disease, toxic algal blooms, and others.

Groundwater Ambient Monitoring and Assessment Program

The Groundwater Ambient Monitoring and Assessment (GAMA) Program was created in 2000 by the SWRCB and it is California's comprehensive groundwater quality monitoring program. GAMA collects data by testing the untreated, raw water in different types of wells for naturally-occurring and human-made chemicals. GAMA compiles these test results with existing groundwater quality data from several agencies into a publicly-accessible Internet database called Geo-Tracker GAMA and is available at http://geotracker.waterboards.ca.gov/gama/. The main goals of GAMA are to improve statewide groundwater monitoring and increase the availability of groundwater quality information to the public.

California Monitoring and Assessment Program

In 2004, California Monitoring and Assessment Program for Wadeable Perennial Streams was initiated. This program builds on EPA's Environmental Monitoring and Assessment Program using a probabilistic monitoring design incorporating land use classes to allow for assessments of status and trends in aquatic life beneficial use protection in streams. Historic Environmental Monitoring and Assessment Program data were analyzed to produce assessments of the condition of streams statewide and in special study areas in Northern and Southern coastal California. Several assessments will also be completed focusing on providing water quality information statewide, and for the broad land use categories such as urban, agriculture, and forested areas. Based upon the highly extrapolative nature of this program, practitioners with intimate familiarity with specific water body conditions have questioned the sensitivity of this approach to identifying barriers to migration, which cause impairment to anadromous fish populations in water bodies displaying generally good water quality. These efforts directly relate to Recommendation 3 of this strategy in the 2005 California Water Plan and can be seen as some success in responding to this recommendation.

Since 2000, California has conducted three successive probability surveys of its perennial streams and rivers, each with a focus on biological endpoints. These surveys are now combined and are managed collectively by the SWAMP under its Perennial Streams Assessment Program. In 2010, SWAMP's Perennial Streams Assessment conducted the SWRCB's eleventh continuous year of probability monitoring of perennial, wadeable streams. To date, the program has collected biological data (invertebrates, algae) and associated chemical and habitat data from approximately 850 probabilistic sites statewide. These surveys have produced a wealth of data that can and should be used to inform many decisions made by California's water resource agencies. For example, the assessments in the *2006 California Water Quality Assessment Report*

(Clean Water Act Section 305(b) Report) were based in large part on data from these surveys. Data from these surveys were also used in the development of the *2010 Integrated Report* (Ode et al. 2011).

Surface Water Quality Assessment and Total Maximum Daily Loads (TMDLs)

The CWA Section 305(b) requires each state to report biennially on the quality and condition of its waters. CWA Section 303(d)(1)(A) requires each state to identify waters within its boundaries which are not meeting water quality standards. The reports submitted by states serve as the basis for EPA's *National Water Quality Inventory Report to Congress*. The SWRCB and RWQCBs conduct physical, chemical, and biological monitoring of the waters of the state and prepare a biennial assessment report for EPA (SWRCB 2012a).

California's CWA Section 303(d) (CWA 303d) Listing Policy sets the rules to identify which waters do not meet water quality standards, even after point-source dischargers have installed the required levels of pollution control technology (SWRCB 2009a). The federal law requires that states establish priority rankings for water on the CWA Section 303(d) list and develop action plans, called Total Maximum Daily Loads (TMDLs) for specific pollutants to improve water quality and protect designated beneficial uses. TMDLs can take various forms, but most commonly are adopted through the basin plans for the region.

Water bodies are most often listed as impaired for sediment, pathogens, nutrients, increased temperature, pesticides, metals, and organic chemicals. The resulting TMDLs are then implemented through the point-source and non-point source regulatory programs such as:

- National Pollutant Discharge Elimination System (NPDES) permits for point-sources (e.g., wastewater treatment facilities, stormwater runoff).
- State waste discharge requirements (WDRs) for point-sources not subject to the NPDES permit program and non-point-source discharges.
- Prohibitions for discharges other than agriculture.
- Conditional waivers of WDRs.

Multiple pollutants can be addressed in a single TMDL or multiple water bodies in a watershed may be addressed in a single TMDL. The RWQCBs are currently developing more than 181 TMDLs, addressing approximately 255 listings in 2011-12. Schedules have been developed for establishing all required TMDLs during a 13-year period. More detailed schedules of work to be undertaken in the short-term have also been developed. The SWRCB *Annual Performance Report* currently provides the number of TMDLs adopted, number of listings addressed by TMDLs, and total number of listings remaining. These performance reports are updated annually and are available at http://www.waterboards.ca.gov/about_us/performance_report_1112/plan_assess/#more.

Many significant pollution problems today are the result of persistent legacy pollutants, such as mercury, that were extracted from the Coastal Range and were used to process gold in the Sierra Nevada mines in the 19th century, industrial chemicals, such as polychlorinated biphenyls (PCBs) used in electrical transformers, and pesticides such as dichlorodiphenyltrichloroethane (DDT). These pollutants also contaminate sediments, making ecosystem restoration efforts more difficult. Hydraulic mining during the 1900s still has an adverse impact on numerous Central Valley rivers and the San Francisco Bay, as well as major parts of the Klamath River watershed. Some environmental contaminants of concern, such as mercury, selenium, PCBs, and DDT are persistent and/or are bioaccumulate up the food chain. These contaminants may negatively impact communities and Native American tribes dependent upon subsistence fisheries.

In 2011, the EPA issued its final decision regarding the water bodies and pollutants added to California's 303(d) Lists and 305(b) Reports, referred to as the *2010 Integrated Report*. This supersedes the 2006 California Clean Water Act 303(d) List as California's current 303(d) List. The 2010 California CWA 303(d) List now includes 87,399 impaired river miles and 7,582,984 acres of impaired lakes and bays. In some cases, a water body is listed for more than one pollutant. There are a total of 3,489 pollutant-water body listings. There have been a total of 1,473 listings addressed, 957 of which were addressed by a TMDL and during the 2010 303(d) listing cycle, and 122 de-listings to date. The *2010 Integrated Report* includes a web-based interactive map and is available at http://www.waterboards.ca.gov/water_issues/programs/tmdl/integrated2010.shtml.

Groundwater Quality

Human activities increase the discharge of salt, nitrates/nutrients, and other pollutants. Such activities include the application of fertilizers (even at accepted optimal agronomic rates), application of imported water for irrigation containing dissolved salts, and industrial, municipal, and domestic wastewater discharges. Salts are leached to groundwater by rainfall or irrigation practices. Additionally, salts in native soils can be dissolved by irrigation water and leached to groundwater. For additional discussion, see Chapter 19, "Salt and Salinity Management," in this volume.

Nitrate pollution of groundwater results from various sources including the use of nitrogen fertilizers, percolation of wastewater treatment plant and food processing wastes, leachate from septic system drainfields, animal corrals, manure storage lagoons, urban parks, lawns, golf courses, and leaky sewer systems. A recent study of the Tulare Lake basin and Salinas Valley growing areas found that nitrate from agricultural fertilizer is the largest threat to groundwater quality in these areas (Harter et al. 2012). Nitrate contamination of community water system wells is also the most frequently detected anthropogenic (human-caused) contaminant, affecting more than 450 wells that are used by more than 200 community water systems statewide (SWRCB 2013). Wellhead treatment programs and blending with higher quality water are both effective at reducing the nitrate level in drinking water supplies. However, the extra cost to remove or reduce nitrate to below safe levels is often expensive and unaffordable for disadvantaged communities. Individual residences served by domestic wells are also at risk if these are located in or near known areas of nitrate contamination. Domestic wells generally tap shallow groundwater making them more susceptible to contamination. Many of these well owners are unaware of the quality of the well water, because the State does not require them to test their water quality. For additional discussion on groundwater contamination, see Chapter 16, "Groundwater/Aquifer Remediation," in this volume.

Groundwater Recharge Area Protection

Protecting recharge areas is important since they provide a primary means to replenishing groundwater supplies. Good natural recharge areas are those where good quality surface water is able to percolate unimpeded to groundwater. If recharge areas cease functioning properly, there may be insufficient groundwater storage for later use. Protection of recharge areas requires a number of actions based on two primary goals: (1) ensuring that areas suitable for recharge continue to be capable of adequate recharge rather than become covered by urban infrastructure such as buildings and roads, and (2) preventing pollutants from entering the groundwater in order to avoid expensive treatment that would be needed prior to potable, agricultural, or industrial uses.

Protection of recharge areas is necessary to maintain the quantity and quality of groundwater in the aquifer. However, protecting recharge areas by itself does not provide a supply of water. Recharge areas only function when aquifer storage capacity is available, and when regional and local governments and agencies work together to protect or secure an adequate supply of good quality water to recharge the aquifer. Climate change may alter precipitation and runoff patterns, which will impact groundwater recharge (see the “Climate Change” section in this chapter). Protecting existing and potential recharge areas allows them to serve as valuable components of a conjunctive management and a groundwater storage strategy.

Zoning can play a major role in protecting a recharge area by amending land use practices so that existing recharge sites are retained as recharge areas. In the past, some areas that provided good rates of recharge were paved over or built upon and are no longer available to recharge the aquifer. Local governments often lack a clear understanding of recharge areas and the need to protect those areas from development or contamination. Land use zoning staff does not always recognize the need for recharge area protection for water quantity and water quality. For further discussion, see Chapter 25, “Recharge Area Protection,” in this volume.

Drinking Water Source Assessment and Protection

Drinking water originates from streams, rivers, lakes, and underground aquifers. These sources usually require water treatment to remove contaminants before it is delivered to customers as drinking water. However, the cost and level of water treatment, as well as the risks to public health, can all be reduced by protecting source water from contamination. Establishing drinking water source assessment and protection programs are necessary to identify contaminating activities and implement practices to protect source water. Ultimately, everyone from government agencies to local communities, including business and citizens, plays a role to ensure that drinking water sources are protected.

Assessment of Drinking Water Sources

The assessment of drinking water sources is the first step to develop a complete drinking water source protection program. A source water assessment is a study that defines the land area contributing water to a public water system source, identifies the major potential contamination activities that could affect the drinking water supply, and determines how susceptible the public water supply is to this potential contamination. The Safe Drinking Water Act requires states to develop EPA-approved programs to carry out assessments of all source waters in their state.

Local communities, water systems, and citizens can then use the publicly available study results to take actions to reduce potential sources of contamination and protect drinking water (EPA 2012). In California, most source water assessments for public drinking water sources have been completed and are available at http://swap.ice.ucdavis.edu/TSinfo/TSintro.asp.

In addition to source water assessments, public water systems that treat surface water are required to conduct a watershed sanitary survey every five years. At a minimum, this survey includes:

- Physical and hydrogeological description of the watershed.
- Summary of source water quality monitoring data.
- Description of watershed activities and sources of contamination that affect source water quality.
- Description of any significant changes that have occurred since the last survey, which could affect the source water quality.
- Description of watershed control and management practices.
- Evaluation of the system's ability to meet water treatment requirements.
- Recommendations for corrective actions to improve source water quality.

These watershed sanitary surveys provide an assessment of the watershed, identify possible contamination sources, and recommends actions needed to protect and improve source water quality.

Protection of Drinking Water Sources

In California, drinking water systems are encouraged to establish a source water protection program to protect their supply sources from contamination. Source water protection measures are established to prevent contamination of groundwater and surface water being used or considered for use as a source of drinking water. These include non-regulatory measures, such as best management practices (BMPs), and regulatory methods such as issuing permits. A source water protection program is a valuable tool for several reasons.

- It is the most cost-effective method to ensure the safety of a drinking water supply.
- It is part of a multi-barrier approach to provide safe drinking water; treatment alone cannot always be successful in removing contaminants.
- It improves public perception of the safety of drinking water.
- It helps to ensure safe drinking water that is essential for public health and economic well-being of communities.

A drinking water source protection program envisions a partnership between local, state, and federal agencies to ensure that the quality of drinking water sources is maintained and protected. Recently, the Central Valley RWQCB launched a multi-year effort to develop a drinking water policy for surface waters in the Central Valley (see Box 18-2).

Box 18-2 Central Valley Drinking Water Source Policy

Public water systems that use surface waters must comply with increasingly stringent laws and regulations designed to provide increasing protection for public health. In August 2000, the CALFED Bay-Delta Program issued a Record of Decision (ROD) requiring the California Bay-Delta Authority, with the assistance of Department of Public Health (DPH), to coordinate a comprehensive Source Water Protection Program. One element of this Source Water Protection Program is to establish a Drinking Water Policy for the Delta and upstream tributaries.

The Central Valley Regional Water Quality Control Board has been working with a workgroup made up of interested stakeholders including federal and State agencies, drinking water agencies, and wastewater, municipal stormwater, and agricultural interests to develop a drinking water policy to help protect drinking water supplies. These efforts resulted in a Drinking Water Policy for Surface Waters of the Delta and Its Upstream Tributaries that was adopted by the Central Valley Regional Water Quality Control Board in July 2013. The policy includes narrative water quality objectives for the pathogens *Cryptosporidium* and *Giardia*, along with implementation provisions, and clarification that the narrative water quality objective for chemical constituents includes drinking water constituents of concern. The workgroup evaluated land use changes and potential control measures that could be expected to occur in the next 20 years. The workgroup concluded that organic carbon would not increase at drinking water intakes based on the cumulative effect of several factors that included reduction in agricultural lands and increasing regulations as well as increased urbanization. While pathogens were not specifically modeled in this effort, current monitoring indicates that the new narrative water quality objective is being met. Additional information is available at http://www.waterboards.ca.gov/centralvalley/water_issues/drinking_water_policy/index.shtml.

Stricter Water Quality Regulations

Over the past 10 years the RWQCBs have begun to impose stricter water quality standards to meet the requirements of the California Toxics Rule and to enforce total maximum daily load (TMDL) allocations. In 2000 the EPA adopted the California Toxics Rule (section 131.38 of Title 40 of the Code of Federal Regulations) which set numeric water quality criteria for California's surface waters. The SWRCB subsequently adopted a *Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California* also known as SIP which is the State's implementation plan for the California Toxics Rule. The RWQCBs then began including monitoring requirements and effluent limits for toxic pollutants in NPDES Permits. Around the same time, the RWQCBs started to adopt TMDL allocations and enforcing these TMDLs in NPDES permits, waste discharge requirements, and conditional waivers.

Land Use Categories and Pollution Prevention

The state non-point source program addresses non-point source pollution by promoting management measures (MMs) and management practices (MPs) for each of the six separate land use categories: agriculture, urban, forestry (silviculture), marinas and recreational boating, hydromodification, and wetlands. Management measures serve as general goals for the control and prevention of polluted runoff. Site-specific MPs are then used to achieve the goals of each management measure. Management practices refer to specific technologies, processes, siting criteria, operating methods, or other alternatives to control non-point source pollution.

The SWRCB, the RWQCBs, and the California Coastal Commission have developed and adopted successive, five-year plans (non-point source implementation plans) to implement the non-point source program strategy. The non-point source 15-Year Strategy (1998-2013) focuses on the progress made in the non-point source program thus far, describes the additional regulatory, educational, and financial tools made available to the RWQCBs, and identifies the need for prioritizing resources and efforts. The goals of the current non-point source implementation plan are similar to those of the past five-year plans (2008-2013) with a closer focus on the following activities:

- Implementing the Policy for the Implementation and Enforcement of the Nonpoint Source Pollution Control Program (non-point source Implementation and Enforcement Policy) by the RWQCBs, particularly through the RWQCB's use of regulatory tools.
- Concentrating non-point source resources on TMDL planning, assessment and implementation priorities, and shifting these funds away from pollution prevention outreach.
- Improving coordination and leveraging of resources with other funding organizations, such as USDA (EQIP), SWRCB's Clean Water State Revolving Fund (CWSRF), Department of Conservation Watershed Program Grants, Department of Water Resources Integrated Regional Water Management, and others.
- Focusing overall efforts and resources on high priority watersheds and problems, as defined by priority TMDLs and other region-specific problems.
- Acknowledging the balancing act required by SWRCB programs to clean up waters polluted by non-point-sources and to preserve clean waters.

In the next five years, the SWRCB expects to have a fully integrated database of existing and tested management measures and management practices, many success stories based on proper implementation and maintenance of these measures and practices, well-established cleanup programs based on actions taken pursuant to the non-point source Implementation and Enforcement Policy, and an accurate assessment of the remaining non-point source pollution problems in the state. The non-point source program strategy will be updated by the SWRCB non-point source program after receiving new EPA non-point source program plan guidance. The goal of this new guidance is to ensure a more cohesive and consistent set of non-point source strategies and reporting requirements for all states. At this time, the SWRCB will be well-positioned to take another long-term look at the future of non-point source pollution cleanup priorities.

The SWRCB has developed the Nonpoint Source Encyclopedia (http://www.waterboards.ca.gov/water_issues/programs/nps/encyclopedia.shtml) to help practitioners choose management practices for implementation. It is a free, online reference guide designed to facilitate a basic understanding of non-point source pollution control and to provide quick access to essential information from a variety of sources. This is done through hyperlinks to other resources available on the Internet. The purpose of the Nonpoint Source Encyclopedia is to support the implementation and development of the non-point source aspects of TMDLs and watershed action plans with a goal of protecting high quality waters and restoring impaired waters. The companion tool, the Management Practices MP Miner (http://mpminer.waterboards.ca.gov/mpminer/), allows users to cull data from studies of management practices, peer reviewed and otherwise, by filtering studies using relevant site-specific variables, such as land use category, pollutant of concern, and removal efficiency required. Both tools are available at the SWRCB Web site as indicated above.

Agriculture

Agricultural activities that cause non-point source pollution can include poorly located or managed animal feeding operations, overgrazing, plowing too often or at the wrong time, and improper, excessive, or poorly timed application of pesticides, irrigation water, and fertilizer. Farm and ranching pollutants include sediment, nutrients, pathogens, pesticides, metals, and salts. To control non-point source pollutants generated from this land use category, agricultural management measures should address:

- Erosion and sediment control.
- Facility wastewater and runoff from confined animal facilities.
- Nutrient management.
- Pesticide application.
- Grazing management.
- Irrigation water management.
- Education and outreach.

Urban

Controlling polluted runoff in urban areas is a challenge. Negative impacts of urbanization on coastal and estuarine waters are well documented in a number of publications including California's CWA Section 305(b) and Section 303(d) reports and the Nationwide Urban Runoff Program. Major pollutants found in runoff from urban areas include sediment, nutrients, oxygen-demanding substances, road salts, heavy metals, petroleum hydrocarbons, plastics, pesticides, pathogenic bacteria, and viruses. In addition to organic carbon and pathogens, suspended sediments constitute the largest mass of pollutant loadings from urban areas into receiving waters. Construction is a major source of sediment erosion. Petroleum hydrocarbons result mostly from automobile sources. Plastics, including plastic bags and bottles, are mainly the result of urban runoff. Nutrient and bacterial sources include garden fertilizers, leaves, grass clippings, pet wastes, homeless encampments, and faulty septic tanks. As population densities increase, there is a corresponding increase in trash and pollutant loadings that is generated from human activities. Many of these pollutants enter surface waters via runoff without undergoing treatment. To control non-point source pollutants generated from this land use category, urban management measures should address:

- Runoff from developing areas, construction sites, and existing development.
- Septic tank systems.
- Transportation development (roads, highways, and bridges).
- Education and outreach.

Forestry (Silviculture)

Silviculture can contribute pollution to rivers and lakes. Without adequate controls, forestry operations may degrade the characteristics of waters that receive drainage from forest lands. Sediment concentrations can increase due to accelerated erosion, water temperatures can increase due to removal of over-story riparian shade, dissolved oxygen can be depleted due to the accumulation of slash and other organic debris, and concentrations of organic and inorganic chemicals can increase due to harvesting, fertilizers, and pesticides. To control non-point source pollutants generated from this land use category, forestry management measures should address:

- Preharvest planning.
- Streamside management areas.
- Road construction/reconstruction.
- Road management.
- Timber harvesting.
- Site preparation/forest regeneration.
- Fire management.
- Revegetation of disturbed areas.
- Forest chemical applications.
- Wetland forest management.
- Postharvest evaluation.
- Education and outreach.

Marinas and Recreational Boating

Recreational boating and marinas are increasingly popular uses of coastal areas and inland surface water bodies (e.g., lakes, the Sacramento-San Joaquin Delta, and San Francisco Bay), and they are an important means of public access to navigable waterways. Therefore, California must balance the need for protecting the environment and the need to provide adequate public access. Because marinas and boats are located at the water's edge, pollutants generated from these sources are less likely to be buffered or filtered by natural processes. When boating and adjunct activities (e.g., those that take place at marinas and boat maintenance areas) are poorly planned or managed, they may pose a threat to water quality and the health of aquatic systems.

Water quality issues associated with marinas and recreational boating include:

- Poorly flushed waterways.
- Pollutants discharged from the normal operation of boats (recreational boats, commercial boats, and live-aboards).
- Pollutants carried in stormwater runoff from marinas, ramps, and related facilities.
- Physical alteration of wetlands and of shellfish/other benthic communities during construction of marinas, ramps, and related facilities.
- Pollutants generated from boat maintenance activities on land and in the water.
- Dredging in marinas and boat maintenance areas.
- Introductions of aquatic invasive species, both plant and animal, that degrade water quality, ecosystem processes, and water infrastructure.

Common pollutants generated from marinas and recreational boating activities include copper, bacteria and pathogens, oil and grease, nutrients, and aquatic and invasive species such as quagga mussels and *Caulerpa taxifolia*. To control non-point source pollutants generated from this land use category, marina and recreational boating management measures should include:

- Marina facility assessment, siting, and design – water quality assessment, marina flushing, habitat assessment, shoreline stabilization, stormwater runoff, fueling station design, sewage facilities, and waste management facilities.
- Operation and maintenance – solid waste control, fish waste control, liquid material control, petroleum control, boat cleaning and maintenance, sewage facility maintenance, and boat operations.
- Education and outreach.

Hydromodification

Hydromodifications that can impair water quality include channel modification (channelization), flow alterations, levees, and dams. Channel modification activities are undertaken in rivers or streams to straighten, enlarge, deepen, or relocate the channel. These activities can affect water temperature, change the natural supply of fresh water to a water body, and alter rates and paths of sediment erosion, transport, and deposition. Hardening the banks of waterways with shoreline protection or armor also accelerates the movement of surface water and pollutants from the upper reaches of watersheds into coastal waters.

Channelization can also reduce the suitability of instream and streamside habitat for fish and wildlife by depriving wetlands and estuarine shorelines of beneficially-enriching sediments, affecting the ability of natural systems to filter pollutants, and interrupting the life stages of aquatic organisms. Dams can adversely impact hydrology, the quality of surface waters, and riparian habitat in the waterways where the dams are located. A variety of impacts can result from the siting, construction, and operation of these facilities. For example, improper siting of dams can inundate both upstream and downstream areas of a waterway. Dams reduce downstream flows, thus depriving wetlands and riparian areas of water. During dam construction or dredging, removal of vegetation and disturbance of underlying sediments can increase turbidity and cause excessive sedimentation in the waterway. Further, metered flows from dams fail to exert the forces that build and maintain channel structure and beneficial floodplain functions.

The erosion of shorelines and streambanks is a natural process that can have either beneficial or adverse impacts on riparian habitat. Excessively high sediment loads resulting from erosion can smother submerged aquatic vegetation, cover shellfish beds and tidal flats, fill in riffle pools, and contribute to increased levels of turbidity and nutrients (EPA 2009a). To control non-point source pollutants generated from this land use category, hydromodification management measures should address:

- Channelization-channel modification.
- Dam construction and operation – erosion and sediment control and chemical pollutant control issues, and the downstream impact of reservoir releases on riparian habitat.
- Streambank and shoreline erosion control.
- Education and outreach.

Wetlands

Wetlands and riparian areas reduce polluted runoff and enhance water quality by filtering out runoff-related contaminants, such as fine-grained sediment, nutrients (nitrogen and phosphorus), and some metals. Functional wetlands and riparian systems provide other services such as surface and groundwater storage, flood control (with adequate set-backs), and storm surge attenuation. They also support valuable wildlife and aquatic habitats. Highly modified wetlands and riparian systems are typically managed for a few beneficial uses or services, are costly to maintain, and have questionable long-term sustainability. Natural wetlands are self-sustaining when not adversely impacted by pollution.

Changes in hydrology, soil texture, water quantity, and/or species composition can impair the ability of wetland or riparian areas to filter out excess sediment and nutrients and therefore can result in deteriorated water quality. Wetlands and riparian areas may be impacted or destroyed by construction, filling, or other alterations. Historically, significant losses of wetlands have been caused by draining wetland soils for conversion to croplands, or dredging wetland soils for waterway navigation. Spongy wetland soils are compacted by over-grazing and grading. Loss of wetland acreage increases polluted runoff, leading to degradation of surface water quality.

To control non-point source pollutants generated from this land use category, wetlands management measures should address:

- Protection of wetlands and riparian areas.
- Restoration of wetlands and riparian areas.
- Vegetated treatment systems.
- Education and outreach.

Potential Benefits

For the vast majority of contaminants, it is generally accepted that a pollution prevention approach to water quality is more cost-effective than end-of-the-pipe treatment of wastes or advanced domestic water treatment for drinking water. Pollution prevention measures that treat or manage concentrated pollutants at the source are usually more cost-effective and practical than attempting to treat larger downstream flows that have diluted the pollutant. By preventing further degradation of water through pollution prevention, there is an overall improvement of water quality over time in both surface and groundwater. Pollution prevention can be considered in the context of adaptation, while pollution treatment is generally associated with mitigation.

Pollution prevention activities, such as stormwater runoff management and low-impact development, can reduce or maintain the peak runoff from urbanized areas such that they can meet the channel capacity of the natural system without the need to construct new protection structures. Additional information is available in Chapter 20, “Urban Stormwater Runoff Management,” in this volume.

Small rural water systems, which generally lack technical and financial capacities, may be more reliant upon pollution prevention measures than other options available to larger systems, such as advanced treatment. When surface water is polluted, the only other available source is groundwater. Therefore, preventing pollution of surface water keeps options for water supply open, which is especially important in areas where the groundwater resources may already be in overdraft.

By protecting the quality of surface water and near-shore coastal waters, this management strategy provides multiple benefits or uses by providing opportunities for water recreation activities, as well as serving as a water source for desalination plants, and maintaining suitable habitat for wildlife. A number of non-point source success stories have been highlighted by the EPA (see Box 18-3 for additional information).

Potential Costs

According to the 2008 EPA Clean Watersheds Needs Survey, California needs more than $30 billion over the next 20 years to meet water quality and water-related public health goals of the Clean Water Act (EPA 2009b). This survey emphasized point-source discharges from wastewater treatment systems, which estimated more than $20 billion is needed to prevent point-source discharges. Measures to address and prevent non-point source pollution were likely underestimated. Currently, EPA is conducting the 2012 Clean Watersheds Needs Survey and is expected to release a final report in 2014. There have been a number of requests and recommendations to represent the funding need for non-point source pollution more accurately in the 2012 survey.

An assessment of water quality conditions in California shows that non-point source pollution has the greatest effect on water quality. It affects some of the largest economic segments of the state's economy, ranging from agriculture to the tourist industry. As previously discussed, non-point-sources are not readily controlled by conventional means. Instead, they are controlled with preventive plans and practices used by those directly involved in those activities and by those overseeing such activities. The following examples provide some insight into the complexity and costs associated with non-point source pollution prevention in California.

Clean Beaches

Runoff from urban areas can contain heavy metals, pesticides, petroleum hydrocarbons, trash, plastics, and animal and human waste (Heal the Bay 2009). This urban runoff can have a detrimental impact on one of California's greatest natural and economic resources, its world-renowned beaches. This natural resource attracts millions of tourists and locals each year. The direct revenues generated by the California beach economy are substantial. Unfortunately, runoff from creeks, rivers, and storm drains creates the largest source of water pollution for the beaches. Often the currents in the bays, around offshore islands, and along sections of the coast can exacerbate pollution by trapping or directing pollutant to a particular area along the coast. Some stretches of beaches in Southern California are permanently posted by local health departments as being unsafe for swimming and surfing, or they periodically post such warnings after storm events. It is recommended that no one swim in the ocean during a significant rain event and for at least three days following a significant rain event due to contaminated urban stormwater runoff draining directly into the ocean. During dry weather, California beaches experience much better water quality, although sewer spills that result in beach closures and other sources of pollution exist year-round.

Box 18-3 EPA Non-Point-Source Success Stories

The EPA has highlighted a number of non-point-source success stories that were identified by states as being primarily non-point-source-impaired and having achieved documented water quality improvements. These highlighted projects have received funding from Clean Water Act (CWA) section 319 and/or other funding sources dedicated to solving non-point-source impairments. The California success stories include the following water bodies:

- Big Meadow Creek and Upper Truckee River.
- Chorro Creek.
- Sacramento and Feather Rivers.
- San Diego Creek.
- San Joaquin Basin (Grasslands Watershed).
- San Joaquin River.
- Whiskeytown Lake.

These success stories are available at http://water.epa.gov/polwaste/nps/success319/index.cfm.

In response to the poor water quality and significant exceedances of bacterial indicators revealed through monitoring at California's beaches, the Clean Beaches Initiative (CBI) Grant Program was initiated by Assembly Bill 411 (Statutes of 1997, Chapter 765). The water quality goal of the CBI is to make beaches safe for recreational ocean water contact. The CBI Grant Program provides funding for projects that restore and protect the water quality and the environment of coastal waters, estuaries, bays, and near-shore waters. Scientific studies have shown that water with high bacteria levels can cause infections, rashes, and gastrointestinal and respiratory illnesses (SWRCB Clean Beaches Initiative 2001).

The CBI Grant Program has provided about $100 million from voter-approved bonds for approximately 100 projects since it began under the 2001 Budget Act. Typical projects include the construction of disinfecting facilities, diversions that prevent polluted storm water from reaching the beach, and scientific research that will enable early notification of unhealthy swimming conditions.

California beaches are an important environmental and economic resource for the state and the nation. Efforts such as the CBI that fund stormwater diversions and other water quality improvement projects are creating benefits that will likely far outweigh their costs. For more information on CBI, go to http://www.swrcb.ca.gov/water_issues/programs/beaches/cbi_projects/index.shtml.

Irrigated Agriculture

In 2012, the Central Valley RWQCB adopted general waste discharge requirements for growers in the Eastern San Joaquin River watershed that are members of the third-party group (East San Joaquin Water Quality Coalition) representing the area. The order covers an estimated 3,600 growers with 835,000 acres under production. The Central Valley RWQCB estimates that the total cost of compliance with this order is expected to be approximately $99 million dollars per year or $119 per acre annually. Approximately $113 of the $119 per acre annual cost is associated with implementation of management practices to protect surface and groundwater quality. Other costs included in the total amount are third-party costs (monitoring, reporting, tracking, and administration), state fees, and farm plans (Central Valley RWQCB 2012a).

Major Implementation Issues

Irrigated Agriculture

Many surface water bodies are impaired because of pollutants from agricultural sources. Statewide, approximately 7,986 miles of rivers/streams and some 310,370 acres of lakes/reservoirs are on the state's impaired water bodies list or Clean Water Act 303(d) list as being impaired by runoff from irrigated agriculture. Agricultural discharges including irrigation return flow, flows from tile drains, and stormwater runoff affect water quality by transporting pollutants such as pesticides, sediments, nutrients, salts (including selenium and boron), pathogens, and heavy metals from cultivated fields into surface waters. Groundwater bodies have also suffered pesticide, nitrate, and salt contamination. A recent report by UC Davis titled *Addressing Nitrate in California's Drinking Water with a Focus on Tulare Lake Basin and Salinas Valley Groundwater* (Harter et al. 2012) found that agricultural fertilizers and animal wastes applied to cropland are by far the largest regional sources of nitrate in groundwater in the Tulare Lake basin and Salinas Valley.

In an effort to control and assess the effects of discharges from irrigated agricultural lands, the Los Angeles, Central Coast, Central Valley, and San Diego RWQCBs have adopted comprehensive conditional waivers of waste discharge requirements. The Colorado River and North Coast RWQCBs have adopted Conditional Prohibitions as a TMDL implementation plan incorporated into their respective basin plans, and the Santa Ana Region RWQCB is in the initial phase of developing an irrigated lands regulatory program. In the future, other RWQCBs may also adopt waivers for agricultural discharges in order to implement TMDLs. An estimated 40,000 growers, who cultivate more than 9 million acres, are subject to RWQCBs' irrigated agriculture regulatory programs in these regions. These RWQCBs have made significant strides to implement their irrigated agriculture regulatory programs and are committed to continue their efforts to work with the agricultural community to protect and improve water quality.

Urban Impacts

Urbanization alters flow pathways, water storage, pollutant levels, rates of evaporation, groundwater recharge, surface runoff, the timing and extent of flooding, the sediment yield of rivers, and the suitability and viability of aquatic habitats. The traditional approach to managing urban and stormwater runoff has generally been successful at preventing flood damage, but it has several disadvantages. In order to convey water quickly, natural waterways are often straightened and lined with concrete, resulting in a loss of habitat and negatively impacting natural stream physical and biological processes. Urbanization creates impervious surfaces, meaning stormwater does not infiltrate into subsurface aquifers. This increases runoff volumes and velocities, resulting in streambank erosion and potential flooding problems downstream.

Urban runoff from both storm-generated and dry weather flows has also been shown to be a significant source of pollution by washing contaminants such as nutrients (lawn fertilizers and pet wastes), pesticides, oil and grease, metals, organic chemicals, human pathogens, and debris (especially plastics and plastic particulates) from city streets and other hard surfaces into surface waters and beaches.

One approach to address urban runoff is the watershed approach, which attempts to emulate and preserve the natural hydrologic cycle that is altered by urbanization. The watershed approach consists of a series of Best Management Practices designed to reduce the pollutant loading and reduce the volumes and velocities of urban runoff discharged to surface waters. These Best Management Practices may include facilities to capture, treat, and recharge groundwater with urban runoff, public education campaigns to inform the public about stormwater pollution, including the proper use and disposal of household chemicals, and technical assistance and stormwater pollution prevention training. Additional information is available in Chapter 20, "Urban Stormwater Runoff Management," and Chapter 25, "Recharge Area Protection," in this volume.

Legacy Pollutants

Abandoned mines and former industrial and commercial sites, such as gas stations and dry cleaning operations, often leave behind contamination problems without a clear link to any legally responsible or financially viable party or entity to pay for the cleanup. State and federal governments and potentially responsible parties often become involved in extensive regulatory and legal proceedings to determine the legal and financial responsibility while the contaminants remain.

Contaminants of Emerging Concern

Traditionally, drinking water systems focus on pathogens (disease-causing microorganisms), chemicals, and disinfectant by-products (potential cancer-causing contaminants) that are regulated or will be regulated in the near future. Recently, other unregulated chemicals and pollutants have been discovered to have unexpected health and environmental effects. Chemicals found in pharmaceuticals and personal care products (PPCPs), by-products of fires and fire suppression, and discarded elements of nanotechnology are emerging as potential water contaminants. Most of these emerging pollutants have not yet been subject to rigorous assessment or regulatory action.

However, there has been progress in understanding which constituents of emerging concern (CECs) impact the environment and drinking water supplies. The Southern California Coastal Water Research Project convened a science advisory panel that released a report on monitoring strategies for CECs in aquatic ecosystems to provide guidance when developing CEC monitoring programs (Anderson et.al. 2012). The San Francisco Estuary Institute recently released a report on CECs in the San Francisco Bay that will serve as a basis for the long-term strategy for future CEC monitoring in the San Francisco Bay (Klosterhaus et.al. 2013). Also the SWRCB amended its Recycled Water Policy in 2013 to include monitoring requirements for constituents of emerging concern (CECs) in recycled water used for groundwater recharge reuse. Information on these monitoring requirements is available at: http://www.waterboards.ca.gov/board_decisions/adopted_orders/resolutions/2013/rs2013_0003_a.pdf. Additional information on

CECs in available in Chapter 12, "Municipal Recycled Water," and Chapter 15, "Drinking Water Treatment and Distribution."

Institutional Barriers

Institutional barriers can contribute to the difficulty of addressing pollution from uncontrolled runoff, especially as the state moves towards a broader watershed approach to pollution prevention and regulatory action. Various state, local, and federal agencies have divided jurisdiction over groundwater versus surface waters, polluted runoff versus point-source discharges, water quantity versus water quality issues, and even over monitoring and assessing pollutants. These various "stovepipes" of regulatory authority can hamper the more holistic watershed approach to water quality management, and will need to be addressed in the coming years. Management and regulation of water quality in California is fragmented among at least eight state and federal agencies, and no one agency is totally responsible for water quality from source to tap. For example, the SWRCB and RWQCBs regulate ambient water quality, while the Department of Public Health primarily regulates treatment and distribution of potable water. Further, surface water storage and conveyance in California is managed mostly by the Department of Water Resources and the U.S. Bureau of Reclamation, while groundwater is usually not managed in a coordinated manner at all. Moreover, providing drinking water to Californians is an obligation of cities, water districts, private water companies, and small water systems that generally were not formed in any comprehensive pattern.

Efforts to coordinate, collaborate, and leverage various agency authorities towards improvements of water quality in California have been initiated and will need to continue in order to alleviate these institutional barriers. Finally, the diffuse nature of non-point source pollution and the need to control sources on private and public land adds to the difficulties of instituting pollution prevention measures.

Climate Change

Climate change may exacerbate concentrations of pollutants in rivers and lakes from multiple sources. Higher temperatures will cause more algal blooms, reducing dissolved oxygen levels and decreasing filter capacity. Storm events following forest fires may result in increased deposition of pollutants in waterways. Also, pesticide application may increase as more pests survive warmer and drier winter conditions. In the urban environment, the projected stronger storms may also overwhelm urban stormwater systems, leading to additional dispersion of pollutants into waterways.

Adaptation

New standards for land use and development, such as fewer impervious surfaces, more on-site use of rainwater, and more vegetated areas should assist to reduce the amount of pollution in populated areas. Forest management techniques, such as small biomass removal and integrated pest management practices, can also reduce the likelihood of catastrophic fires and increased pesticide use to combat pest infestations. Another adaptation measure may include higher levels of treatment for discharges into rivers and lakes. In the agricultural sector, reduced application of nitrogen-based fertilizers could advance adaptation by maintaining groundwater quality for beneficial uses.

Mitigation

Vehicles are one of the major mobile (non-point) sources of pollution. Shifts to reduce vehicle use and away from gasoline-fueled vehicles may reduce the volume of pollutants entering waterways. Fewer pollutants could result in reduced water treatment needs, which would mean less energy usage and fewer GHG emissions. Further adoption of low-impact development measures could also reduce pollution in urban settings. In agricultural settings, additional use of integrated pest management and reduced fertilizer application techniques could reduce the energy use associated with pesticide application and groundwater nitrates treatment. In recognition that biomass resources generated by agriculture can be used as an energy source and as a strategy to address climate change, the dairy industry developed digester facilities that produce electricity from dairy manure. The Central Valley RWQCB supported this effort with the adoption of general waste discharge requirements (Order R5-2010-0116 and R5-2011-0039) that streamline the permitting process for these facilities.

Onsite Wastewater Treatment Systems (OWTS)

In 2012, the SWRCB adopted an Onsite Wastewater Treatment Systems (OWTS) policy to allow continued use of OWTS while protecting water quality and public health. The use of OWTS, including septic tanks and leachfields, can be an effective means of treating and disposing of domestic wastewater in rural locations where centralized wastewater treatment systems are not available. However, there have been occasions in the state where OWTS, for various reasons, have not satisfactorily protected either water quality or public health. Some instances of these failures are related to the OWTS not being able to adequately treat and dispose of waste as a result of poor design or improper site conditions. Others have occurred where the systems are operating as designed, but their densities are such that the combined effluent resulting from multiple systems is more than can be assimilated into the environment. From these failures, California must learn how to improve usage of OWTS and prevent such failures from happening again.

As California's population continues to grow, and there are both increased rural housing densities and the building of residences and other structures in more varied terrain than ever before, there are increased risks of causing environmental damage and creating public health risks from the use of OWTS. What may have been effective in the past may not continue to be effective as conditions and circumstances surrounding particular locations change. So necessarily, more scrutiny of OWTS installation is demanded from all those involved while maintaining an appropriate balance of only the necessary requirements so that the use of OWTS remains viable.

Wastewater Infrastructure Needs

While great strides have been made to provide treatment of wastewater before being discharged to surface water, many older wastewater treatment plants are unable to meet new stricter water quality discharge requirements. As a result many wastewater treatment plants have been upgraded or are planned to be upgraded in the near future to meet these new requirements. In California, the EPA 2008 Clean Watersheds Needs Survey found that more than $26 billion is needed over the next 20 years for wastewater infrastructure needs. (EPA 2009b). The EPA is currently conducting the 2012 Clean Watersheds Needs Survey and is expected to release a final report in 2014. Along with funding capital costs to upgrade a wastewater treatment facility, local and regional wastewater agencies also ensure that new operation and maintenance costs associated with operating an upgraded wastewater treatment facility are funded.

Recommendations

1. Pollution prevention and management of water quality impairments should be based on a watershed approach. A watershed-based approach adds value, reduces cost, promotes cross-media, and integrates programmatic and regional strategies.

2. The Department of Water Resources should collaborate with the SWRCB to integrate the basin plans and other statewide water quality control plans and policies into a comprehensive water quality element of the California Water Plan.

3. The California Water Quality Monitoring Council should include a focus on emerging, unregulated contaminants in order to provide an early warning system of future water quality problems, as well as identify trends in water quality using multiple indicators of health. Drinking water supplies should have outcome-based monitoring, such as biomonitoring and waterborne disease outbreak surveillance. The proposed Interagency Water Quality Program would be modeled after the existing Interagency Ecological Program. The groundwater portion of this effort should be consistent with the recommendations of the Groundwater Quality Monitoring Act of 2001 and DWR Bulletin 118, while the surface water aspects should be coordinated with the SWRCB's Surface Water Ambient Monitoring Program.

4. Regional, tribal, and local governments and agencies should establish drinking water source and wellhead protection programs to shield drinking water sources and groundwater recharge areas from contamination. These source protection programs should be incorporated into local land use plans and policies.

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